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EDITORIAL

THE NEW CHEMISTRY

THE early Greeks were great guessers, as well as fine philosophers. Democritus, who giggled so at the other fellows' findings—that they dubbed him the laughing philosopher—guessed the one-ness of matter, an hypothesis that now seems proven by fact. But the chemistry of the Greeks was a joyful sort of a chemistry, and as naive and primitive as any chemistry could be. Four elements, they claimed, composed the earth and all around it, air, earth, fire and water;—these four, no more—and stirred to action by the fifth—the *quint*-essence, life.

A long while afterward Mendeleef and Moseley complicated things chemical a lot, when their hypotheses ventured the totality of earth's elemental builders to be ninety-two, not one more—not one less.

And so, ninety-two places were set, with due decorum and proper allocation, around the home coming banquet table of nature's simple citizens.

A few guests were late in arriving, but ultimately all reported—the last lone, errant guest taking his proper seat with an air of finality that gladdened the hearts of chemical friends the whole world over. For here, we felt, was the satisfaction of having finally proven the worth of the periodic table—and here the conclusion of a matter that had puzzled chemical thinkers all the way from Aristotle to Zsigmondy and all the time from the year one to now.

But how short lived our satisfaction—how fleeting our feeling of comfort!

For along came Isotope!

—And deuterium, and tritium—and threats of a thousand other elemental multiples to make our chemical comfort a confusion worse confounded.

Professor Taylor, of Princeton University, *explaining* his work on tritium, states:

"In addition to the hydrogen isotope deuterium of mass 2 discovered by Prof. Harold C. Urey of Columbia University, it is now known that a third hydrogen of mass 3 also exists. This still heavier atom of hydrogen has been produced artificially in Cambridge, England, and in Palmer Physical Laboratory of Princeton University by nuclear disintegration processes.

"About a year ago by the use of the mass spectrograph designed by Dr. Walker Bleakney, Princeton physicist, it was shown that the 'heavy water' (deuterium oxide) contained small amounts of the third isotope, tritium, but in a concentration estimated at one part in 200,000 of the 'heavy water' examined.

"During the year the same process of concentration by electrolysis has been continued by Dr. P. W. Selwood of the Frick Laboratory. There now remains a residual ten drops (one-half cubic centimeter) from the electrolysis of 75 tons of ordinary water. The tritium concentration has steadily increased until it is now approximately one part of tritium for every 10,000 parts of deuterium water. The experiments show that in ordinary water this type of hydrogen is present to the extent of only one part in ten thousand million parts of water.

"Similar experiments to ascertain whether the electrolytic process concentrates the heavy oxygen of mass eighteen over that of normal oxygen of mass sixteen have shown that this method is much less efficient. A concentration of water by electrolysis from 120,000 volumes to one volume increased the heavy oxygen concentration merely from one part in 500 to one part in 450.

"While such changes in the ratio of the two species are sufficient for many scientific experiments, it will be necessary to utilize other methods of separation if it is desired to produce pure specimens of the two forms of oxygen similar to those already obtained with deuterium, the heavy hydrogen of mass 2."

Commenting upon the effect the knowledge that hydrogen of mass 3 could be produced by the electrolytic process would have upon scientists, Professor Taylor predicted that it would intensify the interest (*and the confusion*) in this field which was initiated by the discovery of "heavy water."

And to make matters still worse we now learn that all our atomic weights were based upon a false value for hydrogen, and will require complete revision in the very near future.

Every day it grows more evident that our ignorance has been appalling—and every new discovery only discovers how little, how very little we really know and how unanswered still is Pilate's ringing question—"What—*forsooth* is truth?"

IVOR GRIFFITH.

ORIGINAL ARTICLES

A COMPARISON OF THE METHOD PROPOSED BY THE INTERNATIONAL COMMITTEE FOR STUDYING OPIUM ASSAYING AND THE GROUP COMMITTEE METHOD RECOMMENDED FOR ADOPTION IN THE U. S. PHARMACOPOEIA, XI

By A. Richard Bliss, Jr.,* Joseph Rosin,** R. I. Grantham,† and W. H. Blome ‡

This comparative study was undertaken at the suggestion of the United States Commissioner of Narcotics, Mr. Anslinger, and of Dr. C. H. LaWall, a member of the International Committee for Studying Opium Assaying. The details of the two methods studied follow.

I. The Opium Assay Procedure Suggested by the International Committee (Morphine Determination in Opium According to the Lime Method): The powdered opium to be assayed should be thoroughly mixed and passed through a No. 30 sieve so that an average sample may be obtained. This sample should be employed for: 1. Determining the loss of weight on drying at 103 degrees to 105 degrees C. (moisture). 2. Determining the quantity of extractive which is soluble in water in the presence of calcium hydroxide. 3. Determining the quantity of morphine.

1. *Loss of Weight Determination:* Weigh 1.000 gm. of powdered opium in a weighing bottle provided with a glass stopper. Dry for two hours at 103 degrees to 105 degrees C., and then weigh again. Continue the drying until the loss of weight determined at hourly intervals is not greater than 0.005 gm. The loss of weight is expressed in percentage of the opium weighed off. In the formulas which follow, the loss of weight in percentage is represented by "F."

2. *Morphine and Extract Determinations:* Triturate 4.00 gm. of powdered opium with 1.00 gm. of calcium hydroxide and 10 cc. of

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water in a mortar until a uniform mixture is obtained; then stir with another 10 cc. of water and allow to stand for fifteen minutes with repeated stirring; then wash the mixture into a tared flask with small quantities of water, and add water until the mixture weighs 45.00 gm. Stopper the flask, shake vigorously and continuously for one-half hour, and filter through a glass filter 3/g/3 with the least possible suction. Use the filtrate for the extractive and morphine determinations.

3. *Extractive Determination:* Evaporate 3.00 gm. of the filtrate to dryness on a water bath, and dry at 103 degrees to 105 degrees C. until the loss of weight determined at hourly intervals is not more than 0.03 gm. From the weight of the residue, expressed as "M," calculate the extractive content according to the formula:

$$E = \frac{(1000\,F).M}{3.00 - M}.$$ E = per cent. extractive in the opium,

wherein M is the weight of the residue.

4. *Morphine Determination:* Treat 25.00 gm. of the filtrate with 2.5 cc. of alcohol (90 per cent. by volume) and 12.5 cc. of ether, contained in a stoppered flask. Swirl the flask; add 1.00 gm. of ammonium chloride; shake vigorously for five minutes, and then frequently during half an hour, so that taken altogether, the vigorous shaking will take place for fifteen minutes. Allow the mixture to stand overnight. Transfer the ethereal layer as fully as possible to a glass filter 3/g/3; add 5 cc. of ether to the aqueous liquid in the flask, swirl the mixture, and again transfer the ethereal layer to the filter. Wash the filter with 2.5 cc. of ether, and then filter the aqueous liquid also. Wash the flask containing the adhering morphine crystals, and the glass filter with water which has been saturated with morphine until the filtrate no longer reacts for chloride. Dry the glass filter and the flask for one-half hour in a drying oven at 103 degrees to 105 degrees C.

Now dissolve the residual morphine in the flask in 10 cc. of boiling methanol, and pour this solution on the glass filter. Repeat this treatment three or four times using 5 cc. of boiling methanol each time, until all the morphine has gone into solution. Cool, add fifteen drops of methyl red, and titrate with 0.1 *N* HCl to faint redness. Thereupon add 60 cc. of water, whereby the color changes to

yellow, and continue the titration until the color changes to red. Calculate the morphine content according to the following formula:

$$\frac{(1000\ E\ F)\ (0.02852.A\ 0.025)}{25}$$

in which a correction of 25 mgm. is made for the non-precipitated morphine, and in which A represents the quantity of 0.1 *N* HCl required for the titration.

II. The Opium Assay Procedure Recommended by the Group Committee for Adoption in the U.S.P., XI: Triturate in a mortar 6.00 gm. of the opium to be assayed, which, if fresh, should be in very small pieces, and if dry, in fine powder, with about 40 cc. of distilled water for fifteen minutes. Transfer the mixture completely to a flask with the aid of 30 cc. of warm distilled water, stopper the flask and shake it every ten minutes, or continuously in a mechanical agitator during one hour. Pour the contents as evenly as possible upon a wetted filter of from 10 to 11 cm. in diameter or, preferably, upon a glass funnel with a sintered glass bottom attached to a suction flask. When the liquid has drained off, wash the residue with about 20 cc. of distilled water, carefully dropped upon the edges of the filter and its contents. Transfer the moist residue to a mortar, rub it to a smooth paste, then rinse it into the original flask with 40 cc. of distilled water, agitate it thoroughly during ten minutes, and return the entire mixture to the filter.

When the liquid has drained off, wash the residue with small portions of distilled water until the washings are nearly colorless. Evaporate the filtrates and washings, in a *tared* dish, to about 30 gm. and allow to cool. Now add 3 gm. of freshly slaked lime, triturate the mixture for fifteen minutes, and transfer it completely to a tared flask with the aid of small portions of distilled water. Then add sufficient distilled water to make the mixture weigh 54 gm. and mix well. Pass this mixture through a filter of from 10 to 11 cm. in diameter which has not been previously moistened, collecting the filtrate in a dry cylinder or small flask. During the filtration insert the funnel in the neck of the receiving vessel and keep the funnel covered with a glass plate during filtration, and its stem well within the neck of the receiving vessel.

Place 34 gm. of this filtrate (corresponding to 4 gm. of opium) in an Erlenmeyer flask of suitable capacity, add 2 cc. of alcohol and 15 cc. of ether, and, after shaking the mixture, add 1 gm. of ammonium chloride. Stopper the flask, shake it frequently during ten minutes and set it aside in a cool place overnight. Remove the stopper and brush any adhering crystals back into the flask. Decant the ethereal layer through a small filter paper. Rinse the flask and contents with 15 cc. of ether and pass these washings through the filter, and again wash the filter with an additional small quantity of ether. When the ether has all passed through the filter, pour the aqueous layer onto the filter without trying to remove the crystals. Wash the crystals in the flask and the contents of the filter with distilled water previously saturated with morphine, until the washings are colorless. Then add a few drops of distilled water to replace the morphinated water. Add to the flask containing the crystals about 10 cc. of hot neutral methanol, agitate to dissolve as much morphine as possible in the flask and pour the solution over the morphine on the filter, receiving the filtrate in a suitable flask. Repeat this treatment with hot methanol three or four times, using from 5 to 7 cc. each time, until all of the morphine has been dissolved. Cool this solution and add exactly 20 cc. or 25 cc. of tenth-normal sulfuric acid. Dilute this solution with 50 cc. of distilled water and titrate the excess of acid with tenth-normal sodium hydroxide using methyl red T. S. as the indicator. Each cc. of tenth-normal acid is equivalent to 0.0285 gm. of anhydrous morphine.

The results obtained are compiled in the table on next page.

Discussion

The proposed international method includes a very substantial correction which is, in the opinion of the authors, too great. The correction corrects for solubility but, on the other hand, it does not correct for alkaloids other than morphine which are invariably precipitated at the same time and to the extent of from 0.25 to 0.5 per cent. The method requires two extra determinations in addition to that of morphine; viz., the moisture, and the extractives. This makes the actual time consumed by this procedure somewhat longer than that required by the group committee's procedure. The international method calls for, in the final determination, only about 2 gm. of opium as compared with 4 gm. in the group committee's method, and this tends to magnify any error made when using the smaller quantity

of opium. Furthermore, experience has taught that in the case of gum opium, which is probably the most important form of the drug, a larger sample is more desirable from the point of view of representative sampling. The end point in the international method is not sharp.

Although the proposed international committee's method yields results which check satisfactorily, the lack of sharpness in the end point, the absence of any time-saving factors, the potential hazard attending the use of smaller quantities of samples (especially in the case of gum opium), the apparent inaccuracy of the correction factor and the inconstant variations in results obtained by different collaborators combine to establish the fact that the proposed international committee's method is inferior to the method recommended by the group committee for adoption in the U. S. P. XI. (See Bliss et al., Amer. J. Phar., September, 1933, pp. 457-465.)

TABLE I. RESULTS OBTAINED WITH THE INTERNATIONAL COMMITTEE'S AND THE GROUP COMMITTEE'S METHODS

Collaborator		Proposed International Committee's Method	Group Committee's Method
Joseph Rosin	13.30*	(Gum Opium No. 162-C)	12.70*
	14.43	(" " " 165-C)	13.91
	11.80	(" " " 166)	11.58
	11.77	(" " " 167)	11.47
	9.74	(Granulated Opium)	9.63
R. I. Grantham	14.64	(Gum Opium)	16.83
	14.68		16.78
Average	14.66		16.795
	9.50	(Powdered Opium)	10.50
	9.57		10.63
Average	9.535		10.565
†W. H. Blome	9.603	(Powdered Opium)	9.76
	9.728		10.66**
Average	9.665		10.21
†A. R. Bliss, Jr.	10.22	(Powdered Opium)	9.86
	10.10		9.72
Average	10.16		9.79

*Figures represent the per cent. of morphine.

†Samples assayed by Blome and Bliss were from the same lot. Rosin and Grantham provided their own individual samples.

**Duplicate started at such time that it had to stand overnight and Sunday, which it is thought accounts for the discrepancy.

Correspondence

March 25, 1935.

Ivor Griffith, Editor,
American Journal of Pharmacy,
Forty-third Street and Kingsessing Avenue,
Philadelphia, Pa.

Dear Sir:

Recently I received a letter from the Commissioner of Narcotics calling attention to an item which appeared in the AMERICAN JOURNAL OF PHARMACY of September, 1934, relative to the Kabay process for making morphine from so-called poppy straw. The commissioner refers to an error in the percentages of yields of morphine and codeine from the raw material used, it being represented that the statements of yields were ten times too large. It was argued, the communication goes on to say, that this exaggerated statement of yields might inspire the growth of the opium poppy in the United States with the intention of extracting alkaloids by the Kabay method.

The commissioner's further comments are quoted below:

> "This matter was taken up with the State Department to obtain its views as to the possibility of correcting the apparently erroneous impression of yields by the Kabay method, by making available the actual yields as ascertained from an authoritative source. I am now authorized to advise that in accordance with a League of Nations document, the Hungarian Government in a memorandum in regard to the Alkaloida Company (Kabay) process stated last autumn that 'The results of manufacture give an average morphine base of 0.8 per mille and codeine base of 0.08-0.04 per mille.' I therefore suggest that you, as the representative of the domestic manufacturers, communicate this correction to the publishers of the American Journal of Pharmacy and of Industrial and Engineering Chemistry, with the recommendation that they publish the correct information in order to correct any erroneous impression that may have been obtained by their subscribers from the former articles on the Kabay process."

Commending the foregoing to your attention, I am,

Cordially yours,
CARSON P. FRAILEY,
Executive Vice-President, American Drug Manufacturers Association.

THE RED PILL OR THE OPIUM SUBSTITUTE

By Peter Valaer

Washington, D. C.

ACCORDING to reliable sources of information the practice of smoking pills containing a certain proportion of heroin or morphine came into notice in China in 1922, although the practice began, it is certain, a long time before that. Since that year there has been observed a steady increase in addiction which in recent years has became prevalent to such an alarming degree that it exceeds, it is said, the smoking of opium itself. It is very much cheaper than opium, costing less than two cents per pill retail. On this account the poorer opium smokers are turning more to these heroin and morphine pills (red pills) for smoking.

About the fall of 1928 notice was first obtained that there was being manufactured in China, particularly in Shanghai, enormous quantities of heroin pills (red pills). Addresses were found at some of these plants of places in the United States, but on investigation of these American locations nothing in the way of narcotics was found. It was not until 1932, on narcotic raids on Chinese premises in Detroit and Chicago, that red pills and special pipes were found, but when the chemists reported no opium derivatives, charges were not made. It is significant that one of the addresses forwarded in September 1928 was that of Wing On, 2203 Wentworth Avenue, Chicago, Illinois. Just four years later, August, 1932, the first red pills were discovered in the United States, in the next block, at 2111 Wentworth Avenue, Chicago, Illinois, by United States Narcotic Agents. About that time information was received in the United States that small purple boxes of red pills were being sold in open markets in China as a cure for drug addiction. Samples of these sent to Washington were found to contain morphine, starch, sugar, caffeine, quinine, strychnine and coloring matter (coal tar dye). They were regular "red pills" used for smoking.

From a study of the existing available information and from various chemical examinations, there appears to be two groups of red pills, both of which contained caffeine, cinchonine, and small traces of strychnine, quinine, starch, sugars, gums, coloring matters and perfume but the main distinction being the quantities of heroin contained. One group containing approximately 2 per cent. heroin and the other group very minute quantities amounting to one-tenth

of one per cent. and upward which has made the examination of these pills a serious chemical problem. Types of these pills have been found on raids in Chicago conducted by United States narcotic agents in 1932 and also in Boston in 1934 and in New York and San Antonio in March 1935. The red pills obtained on the Chicago raids were all apparently of the same kind, being darker red in color and slightly larger than those obtained in Boston. The Chicago pills were colored with eosin while the Boston pills were colored with a combination of coal tar dyes. They were found to correspond to fast red VR plus seriochrome blue R. The fact that no less than six chemists in the United States particularly skilled in narcotic alkaloidal work had up to October, 1934, tried and failed to find opium alkaloids illustrates the very complicated character of this particular type of Red Pill. The analyses of the various chemists show that these pills contain about the same ingredients but they vary in percentages of their composition. The pills in general are quite hard but can be crushed and are the same color inside and out. When warm they become soft and can be manipulated with the hand. The hot solution of the Boston pills had an odor very much resembling that of cherries. They can be ignited with a match and they continue to burn almost completely to a swelled, black, charred mass. The odor of the burning pill is not characteristic of anything except that of burning sugar. When heated in a long tube there does not appear to be any sublimate formed on the sides of the tube, only the black charred mass, swelling and expanding far up the sides of the tube as if the mass consisted only of sugars. They are rough to the touch and under the magnifying glass appear granular. When dissolved the solution is not clear but milky, due to the interspersed corn starch grains. These corn granules are perfect in form, showing that the mass was made up cold and no heat was applied anywhere during the process of manufacture. The red coal tar dye coloring is easily removed from the acid solution with a piece of white wool, all of the dye fixing rapidly on the wool, leaving the solution colorless. This solution could be used, if desired, for analysis without color interference. After a good deal of experimental work in which older chemical procedures had to be revised, the narcotic drugs (derivatives of opium) were found in the pills from the raids in Chicago and the pills found in Boston. After this previous experience heroin was readily obtained quantitatively from the New York and the San Antonio pills.

The typical analysis of the Red Pills from Boston was as follows:

Moisture	6.88%	
Starch	4.54%	
Ash	.175%	
Caffeine	5.72%	
Cinchonine	3.74%	
Heroin	.12	(Calculated as commercial heroin)
Trace of Strychnine.		

The remainder of the pills being lactose, other sugars, gum and flavoring.

Evidently the mass was not uniform because another analysis showed:

Caffeine	4.1%
Cinchonine	3.08%
Heroin (Commercial)	.22%

Still another analysis indicated 0.26% heroin.

See detailed method of analysis at end of article for this type of pill.

The other group of pills are those made in Shanghai and perhaps other parts of the Far East. Those examined were known as Wusih Red, Shanghai Pink, Shanghai Red, Wusih Black, and Inferior Coolie. It was stated that they were sold in open market there as a cure. They were contained in small, flat, square, purple boxes secured with an ivory clasp. The typical analysis of these pills is as follows:

The pills were smooth, hard, brittle, imperfect spheres of a rather dingy, various shades of pale rose color. They contained 7.1 per cent. of caffeine, and 2.46 per cent. of quinine. Each pill contained approximately one-thirtieth of a grain of strychnine, morphine calculated to the sulphate 1.25 per cent. and eosin coloring matter.

These pills were different in appearance from the first group of pills, having a different color, hardness, texture and general chemical composition. Less is known about them due to the fact that only a few pills were available at any one time and no extensive chemical examination could be made. In all instances this type of

pill showed opium alkaloids, sometimes heroin, sometimes morphine. Under the miscroscope they look entirely different from the Chicago and Boston pills in that they are smoother in texture and to the feel and vary in color from a dull pale red to a dirty white. It is comparatively easy to find narcotic drugs in these pills. These pills, positively known to come from China, can be tested directly with formaldehyde-sulphuric acid (Marquis Reagent). They will show this characteristic color reaction for the opium alkaloids.

The usual method of smoking "Pink or Red" pills is very similar to the smoking of opium. It requires a pill pipe, a long needle (yen hook) and a lamp. The pill pipe is made of a bamboo stick about a foot long attached to a porcelain head (a small cheap teapot) having a hole in the top, sometimes the equipment consists of a stem inserted in the spout of small China tea pot. The whole bowl is sealed except a small hole upon which the burning pill lays during the smoking. The burning residue is rarely recovered being much less valuable than yen shi, the residue from smoked opium. This pipe used is much cheaper than the regular opium pipe costing only a few cents.

The smoking of pills is more convenient than the smoking of prepared opium. The pills are ready for smoking in the state as sold whereas opium must be specially prepared to be ready for consumption. The pill smoker holds the pill on a needle close to the pipe head over the flame of an oil lamp and draws a few times, inhaling the smoke. Most of the red heroin pills have small holes so they can easily be pierced with the hot yen hook (needle) during the process of smoking. The quantity of pills consumed depends on the degree of addiction, varying from 16 to 100 pills a day.

The factories engaged in the manufacture of heroin pills vary from crudely assembled plants to those of much larger operations, the latter often showing considerable technical knowledge and control.

In the Yangtszepoo district of Shanghai was found a plant in operation in which there was over $10,000 worth of equipment. The crude morphine used in the manufacture of the pills is said to have been smuggled into Shanghai from the interior of China by way of the Yangtse River; it is usually dark brown in color and often still retains a definite opium odor.

The method of manufacture of red pills consists in making up a combination of heroin or morphine, caffeine, quinine, cinchonine

or other cinchona alkaloids, a trace of strychnine, cane or milk sugar (lactose) flour or starch, with tragacanth or other binders plus a dyestuff, usually eosin and other red dyes, sometimes a mixture of red and blue dyes. In some red pills sent from China, there were present quinine alkaloid and eosin dye but in the pills found in several places in the United States there were found cinchonine and a mixture of red and blue coal-tar dyes; sometimes the red pills are slightly scented. Red pills from Boston gave off a pleasant cherry like odor when boiled in solution. It seems that the pill mass varies quantitatively with each illicit manufacturer. In manufacturing, the pill mass is rolled out and cut on an ordinary hand pill machine as is used in any pharmacy and the pills rounded by hand; they are then dried in ovens or in desiccators, often using quick lime as a drier.

The chemicals and other materials that have been found on the premises of red pill factories which have been raided, are as follows:

Quinine	Lime	Ether
Caffeine	Citric Acid	Acetic Anhydride
Strychnine	Cane Sugar	Hydrochloric acid
Morphine	Flour	Alcohol
Heroin	Brown Sugar	Soda ash (sodium carbonate)
Red Dye	Tragacanth	Ammonium Chloride
Icing Sugar	Acetic Acid	Rose Floral essence
Milk Sugar	Chloroform	Jasmine Oil.

There is a strange contradiction in the information received concerning the traffic in "red pills". These pills are being found, it is said, sold with impunity as a cure for drug addiction in the streets of some of the cities in China, particularly Shanghai. In an American newspaper, dated December 14, 1934, appeared the information that in Shanghai a woman was shot by a firing squad for smoking "red pills". These pills that were held out as a cure actually contained more heroin and morphine than some of the pills that were intended for smoking purposes or addiction, the general composition of all red pills being qualitatively about the same.

In March of this year (1935), there were analyzed gray tablets from China called "Anti-Narcohab" showing 1.85 per cent. morphine, 2 per cent. quinine and strychnine and 6.32 per cent. caffeine; also present were starch, a binder and sugar. These pills marked

"Made in Germany" were held out "as a cure". These pills were not red or round but were qualitatively the same as the so-called smoking red pill except containing higher per cent. of narcotic drug.

In speaking of "red pills", there are included all the color shades of Chinese heroin pills. Among the colors already mentioned are yellow and deep red, including dingy white and black pills, the composition of the latter is the same as the "red", apparently the only difference being that a blue-black dye was used as coloring. About the end of March of 1935 there were again found on raids in San Antonio, Texas, and in New York "red pills"; these pills showing about the same general composition as the "red pills" found in Boston in October of 1934, except that they were slightly deeper red with some coal tar dye mixture, also with more morphine (or heroin). The pills obtained in San Antonio, Texas, contained .41 per cent. anhydrous morphine (as extracted); 3.8 per cent. cinchonine and 4.35 per cent. caffeine. Reports from New York state that an opium derivative was found in the pills seized on raids during the latter part of March.

It is thought by students of these affairs that it is intended to use heroin in all of the red pills as the principal narcotic ingredient. The presence of morphine, it is claimed, is due to the crude method of converting morphine into heroin. There remains in the pill mixture some unconverted morphine. It is also due to the unstable character of heroin, which changes back to morphine under certain conditions.

Methods that have been employed in Europe for the analysis of red pills fall also into two classes, the easily determined general chemical procedure for quantitative results on morphine or heroin when present in large quantities as in the 2 per cent. narcotic pills. This comprises analysis by extraction from acid and alkaline solutions with chloroform and isopropyl alcohol as solvents and the use of Rochelle salts for separation of quinine and strychnine. Another method is of very great interest and unique in form in that the pills are artificially smoked in an aspirating device, the alkaloids being sublimated and driven over with the white smoke formed, having the caffeine sublimate as the carrier for the other alkaloids, all being trapped in alcohol and dilute acid in their pure state. These solutions in turn being readily extracted by the suitable solvents for identification and partial quantitative work. This also shows that the smokers of these red pills obtained these alkaloids into their systems

in pure form, producing their characteristic individual physiological results on the smokers. The authors of the above procedure state that there is no known method for arriving at quantitative results where these morphine derivatives or morphine itself are present as is found in the pills with the low content approximating one-tenth of 1 per cent. of the narcotic drug.

Below is shown the method worked out in the Treasury Laboratory by the authors of this article for the class of red pills containing this minute trace of narcotic drug (heroin or morphine).

Method for Heroin and Morphine in Red Pills

As Developed by Mallory & Valaer, Chemists of the U. S. Treasury Department

Weigh and crush the pills, preferably between 10 to 40, in a mortar and wash out into a 500 cc. Ehrlenmeyer flask with 75 cc. of water containing 3 cc. concentrated sulfuric acid. Reflux two hours under water cooled condenser.

Cool, pour into separatory funnel, add a piece of litmus paper, neutralize with 1:1 NaOH and then add 6 cc. of 10 per cent. NaOH in excess and shake out immediately with three portions of chloroform, 100 cc. or more each time. Save chloroform for analysis of other alkaloids if desired.

Make alkaline solution acid with concentrated sulfuric acid. Then add 20 cc. of 95 per cent. alcohol (5 cc. for each 25 cc. solution). Add 28 per cent. ammonium hydroxide until just alkaline avoiding any excess over one drop. Shake out immediately and thoroughly with 125 cc. of chloroform containing 10 per cent. alcohol. Draw off chloroform-alcohol layer and filter through cotton wetted with chloroform into a beaker. Repeat, shake out with another 125 cc. of chloroform alcohol solvent. Evaporate solvent to dryness.

Take up residue in beaker with 10 cc. of .5 N. sulfuric acid and 25 cc. of chloroform and transfer to separatory funnel and wash beaker again with 10 cc. water and add washings to separatory funnel.

Shake and then draw off chloroform into another separatory funnel referred to as No. 2. Wash acid solution with 10 cc. chloroform and add to other chloroform in No. 2. Shake chloroform in No. 2 with 5 cc. .5 N. sulfuric acid plus 5 cc. water and draw off and discard chloroform. Add acid solution to main acid solution in separatory No. 1. Shake acid solution with 40 cc. anhydrous ether.

Separate. Wash ether with 10 cc. water and add water to main acid solution. Discard ether.

To the acid solution add 1 cc. of concentrated sulfuric acid in 2 cc. water and neutralize with 10 per cent. NaOH to just alkalinity. There is no need to cool this solution, the heat formed will drive off the remaining ether. Add a drop of concentrated sulfuric acid to acidity and shake to be sure solution is acid. Add 10 cc. of 95 per cent. alcohol and shake thoroughly and then make just alkaline with 28 per cent. ammonium hydroxide, a drop at a time, to just alkalinity. Add at once 125 cc. of chloroform containing 10 per cent. alcohol and shake thoroughly and continuously for at least fifteen minutes. Allow to settle, draw off solvent into a clean separatory funnel, wash first with 10 cc. of water and again with 5 cc. of water. Filter through cotton into a 250 cc. beaker and evaporate on steam bath under an electric fan. To the residue add 5 cc. of absolute alcohol, three drops of .1 N. sulfuric acid and 1 cc. of water and heat on steam bath until alcohol is driven off and only approximately four to five drops solution remains, tilting beaker in hole of steam bath for final evaporation.

Cool. Take one drop on end of stirring rod and place in small porcelain evaporating dish and evaporate slowly on steam bath. Cool and add drop of fresh Marquis Reagent and push through residue with glassrod for color reaction. Any morphine present will give the distinctive identifying color without any doubt if present.

On a slide mark a square of warm paraffin covering the main central half of slide—using warm stirring rod. In center, place most of balance of solution by use of a stirring rod and add to it a large drop of .1 N. Iodine. After 15 minutes or before it starts to dry up add another drop of .1 N. Iodine and at end of 30 or 40 minutes or even an hour examine for crystals formed around edges or throughout plate. It may take two hours to get characteristic crystals.

Characteristic morphine iodine crystals have been obtained from 1/1000 grain of hydrolyzed heroin or .000065 grams. This was the amount of heroin found in one pill weighing .25 grams. This particular batch of pills contained 4 per cent. caffeine and 5 per cent. cinchonine in addition to the small amount of heroin.

The Marquis reagent was found to be positive with 1/50000 grain of morphine from the hydrolyzed heroin. This is equivalent to .0000013 grams.

We have found that the presence of appreciable amounts of cinchonine and other alkaloids prevent the color test being obtained from heroin and morphine derivatives when these last alkaloids are present in traces. It is necessary to hydrolyze heroin in order to isolate morphine in a pure state.

The above method may be used for quantitative results where larger quantities of morphine or heroin are indicated but wherever the shakeouts with $CHCl_3$-10 per cent. alcohol are stated make three shakeouts in each case instead of the one or two given.

Solutions must not be left alkaline for any great length of time but extracted at once.

We have found that cinchonine with platinic chloride reagent gives crystals which may be very easily mistaken for heroin with the same reagent. This is also true with mercuric chloride reagent, especially when caffeine and cinchonine are mixed together and used with either of the above reagents.

The above method is applicable to suspected cigarettes, dried poppy capsules or other similar materials.

It should be understood that the principal function of this work in the first place was the separation and the positive identification of the minutest amounts of heroin or morphine from red pills or similar materials when mixed with relatively large quantities of other alkaloids as caffeine, cinchonine, quinine, and traces of strychnine, etc.

In order to make the results *quantitative* if 10 or more pills are obtainable or if the percentage of heroin or morphine is large, the extractions must necessarily be carried to complete extractions, placing the wash waters back with the main aqueous solutions each time before the succeeding extractions. Also it is most desirable on the extractions whenever $CHCl_3$ plus 10 per cent. alcohol are used to always, prior to each extraction, make the ammoniacal solution just acid but distinctly acid with H_2SO_4 and then ammoniacal again.

The final residue is of such a purity that it can be weighed directly for quantitative results and if enough weight is obtained it may be checked by titration with N/50 acid and N/50 alkali. To the residue add 15 cc. of neutral ethyl alcohol or methyl alcohol and dissolve, then N/50 H_2SO_4 with 5 cc. in excess and 40 cc. of recently boiled and cooled distilled water. This is heated on the steam bath to drive off the alcohol, stirring thoroughly to put all the alkaloid in solution, cooled and then titrated back with N/50 alkali. Methyl red used for indicator.

Each cc. N/50 H_2SO_4 = .0057 gm. anhydrous morphine.

STUDIES IN THE USE OF 2,4-DINITROPHENYLHYDRAZINE AS A QUANTITATIVE REAGENT FOR CARBONYL COMPOUNDS: II. BENZOPHENONE AND ACETONE

By G. W. Perkins and Myles W. Edwards

(Contribution from the Organic Chemistry Laboratory of the Philadelphia College of Pharmacy and Science.)

CONTINUING studies previously reported from this laboratory, we have extended the use of 2,4-dinitrophenylhydrazine as quantitative reagent to the determination of benzophenone and to acetone. The qualitative (1) and quantitative (2) studies in this laboratory have been modified from the original suggestions made by Brady *et al.*,(3) and Allen (4). Since the completion of the studies reported in this paper, Iddles and Jackson (5) have published results obtained in the determination of carbonyl compounds using a hydrochloric acid solution of the reagent. The reagent used in the following determinations was prepared as described by Houghton.(2)

Benzophenone

Benzophenone (E. K. Co.) was recrystallized three times from an alcohol-water solution and found to have a melting point of 47.6°

TABLE 1

	Weight of Benzophenone taken	Weight of Precipitate	Weight of Benzophenone found	Per cent. recovered
1.	0.2050 Gm.	0.4017 Gm.	0.2020 Gm.	98.5
	0.2012 "	0.3931 "	0.1977 "	98.2
2.	0.2022 "	0.3986 "	0.2004 "	99.1
	0.2035 "	0.4996 "	0.2014 "	98.9
3.	0.1975 "	0.3901 "	0.1962 "	99.3
	0.1986 "	0.3919 "	0.1971 "	99.2
4.	0.2003 "	0.3932 "	0.1977 "	98.7
	0.2006 "	0.3969 "	0.1973 "	98.6
5.	0.2013 "	0.3984 "	0.2003 "	99.5
	0.2006 "	0.3969 "	0.1992 "	99.3
6.	0.1992 "	0.3954 "	0.1998 "	99.3
	0.1998 "	0.3927 "	0.1974 "	98.8
7.	0.2016 "	0.3909 "	0.1966 "	97.5
	0.2124 "	0.4111 "	0.2067 "	97.3
8.	0.2048 "	0.4058 "	0.2041 "	99.6
	0.2011 "	0.3983 "	0.2007 "	99.5

C. Approximately 0.2 gram of benzophenone was dissolved in 10 cc. of 1:1 alcohol water solution and to this was added slowly with stirring 50 cc. of reagent. The precipitate formed was stirred well and allowed to stand over night. After filtering through a weighed Gooch crucible the precipitate was dried to constant weight at 105° C.

Acetone

Acetone (C. P. grade) was dried over anhydrous calcium chloride and redistilled. The fraction boiling at 56° C. was taken for analysis. Samples were weighed from a small weighing bottle fitted with a dropping tube. The acetone samples varied from 70 to 120 milligrams in weight, and were added directly to 100 cc. of the reagent. The solution was stirred vigorously for at least eight minutes and then allowed to stand over night, filtered, washed and dried as in the case of benzophenone.

TABLE 2

	Weight of Acetone found	Weight of Precipitate	Weight of Acetone found	Per cent. recovered
1.	0.1226 Gm.	0.4968 Gm.	0.1208 Gm.	98.54
	0.1012 "	0.4120 "	0.0999 "	98.78
2.	0.0986 "	0.3999 "	0.0972 "	98.28
	0.1124 "	0.4447 "	0.1082 "	98.46
3.	0.1324 "	0.5421 "	0.1319 "	99.58
	0.1216 "	0.4999 "	0.1215 "	99.98
4.	0.0824 "	0.3337 "	0.0816 "	98.71
	0.0790 "	0.3203 "	0.0779 "	98.61
5.	0.0828 "	0.3301 "	0.0809 "	97.53
	0.0816 "	0.3242 "	0.0795 "	97.43
6.	0.0708 "	0.2912 "	0.0707 "	99.89
	0.0635 "	0.2628 "	0.0639 "	100.64
7.	0.1142 "	0.4632 "	0.1136 "	99.46
	0.1328 "	0.5370 "	0.1317 "	99.16

Benzaldehyde

We have also repeated the determination of benzaldehyde with the 2,4-dinitrophenylhydrazine reagent with somewhat better results than that obtained by Houghton.(2) A number of factors affect the accuracy of the determinations which in the case of benzaldehyde may also be self-compensating. Iddles and Jackson (5) investigated the influence of time, concentration, temperature and dilution. They

prefer to carry out the precipitation of benzaldehyde at zero degrees. Since the reagent they use is saturated (presumably) at room temperature, on cooling to zero degrees the solubility of the 2,4-dinitrophenylhydrazine will be decreased. An aqueous solution of benzaldehyde is added to the reagent, it would therefore seem that conditions would be such as to give high results due to occlusion of the reagent. However their stock aqueous benzaldehyde solution would tend to auto-oxidize (6) which would introduce a compensating factor. Dilution after precipitation would not correct for this. The precipitates obtained in the other carbonyl determinations made by Iddles and Jackson may also possibly be contaminated with occluded reagent. Since the reagent itself is only sparingly soluble in water, the addition of the reagent slowly and with stirring to the carbonyl compound will no doubt reduce occlusion to a minimum. Our results are comparable with those of Iddles and Jackson, precipitated at room temperature.

TABLE 3

	Weight of Benzaldehyde	Weight of Precipitate	Per cent. Benzaldehyde
1.	0.0964 Gm.	0.2477 Gm.	95.60
	0.0986 "	0.2531 "	95.12
2.	0.1092 "	0.2862 "	97.37
	0.0972 "	0.2552 "	97.32
3.	0.0932 "	0.2345 "	93.30
	0.0984 "	0.2533 "	93.24

The benzaldehyde was distilled from a small distilling flask and collected in a weighing bottle fitted with a small dropping tube. Samples of benzaldehyde were weighed by difference and placed in 5 cc. alcohol. Just before precipitating, 50 cc. of water were added, then 50 cc. of our reagent added slowly with stirring. After standing over night, the precipitates were filtered, washed and dried to constant weight at 110° C.

We are continuing these studies on the determination of carbonyl compounds and investigating the hydrolysis and solubility of some of the 2,4-dinitrophenylhydrazones. It would seem that better results might be obtained by the selection of a different solvent other

than water, in which there will be a greater differentiation in solubilities of the reagent and the precipitate.*

Summary

We have extended the use of 2,4-dinitrophenylhydrazine as a quantitative reagent to the determination of benzophenone and also to acetone. Some observations have been made concerning the determination of benzaldehyde.

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2. Houghton, R.: *Am. J. Pharm.* 106, 62, 1934.
3. Brady and Elsmic: *Analyst*, p. 77, 1926; Brady and Peakin: *J. Chem. Soc.*, p. 131, 1929; Brady: *Ibid.*, p. 756, 1931.
4. Allen: *J. A. C. S.* 52, 2955, 1930.
5. Iddles and Jackson: *Anal. Ed. Ind. Eng. Chem.* 6, 456-457, 1934.
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Polyvinyl Acetate in Safety Glass Manufacture. A report from Germany indicates that polyvinyl acetate is now used on a comparatively large scale as the intermediate layer in safety glass manufacture in a recently-constructed factory. In contrast to safety glass manufacturing processes in which the sandwich material is applied in the form of a previously manufactured foil, the new process applies a solution of the polyvinyl acetate to each of the two glass surfaces which are to be united. The solution is distributed on the cleaned glass surfaces through a pouring machine with a slit-like orifice, the coated glass sheets then travelling through a well-heated airtight drying chamber about 30 meters long (from which the solvent is ultimately recovered). This stage occupies several hours, slow evaporation of the solvent being essential to avoid bubble formation. Before bringing the coated surfaces together, the glass sheets are subjected to a final drying operation in a vacuum in order to eliminate solvent traces as far as possible. The final union of the coated faces is carried out in hydraulic presses, this operation being facilitated by moistening the vinyl acetate-coated faces with a plasticizer. This type of safety glass offers the advantage of not requiring edge-sealing. From Continental Chemical Notes, *Chemical Age, 32,* 296 (1935).

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*Dr. E. C. Wagner has kindly suggested that dioxane might be a suitable solvent to replace water. Studies are now being made along this line.

A NEW LACTOMETER, READING TOTAL SOLIDS

By David Wilbur Horn, Ph. D.

THE new lactometer herein described (1) has a scale that reads directly in terms of percentage of total solids. The scale reading is predicated upon a butter fat content of 4 per cent., and is subject to a correction amounting to 1.2 per cent. of total solids (2) for each variation of 1 per cent. of butter fat in the milk. Throughout its scale length the new lactometer is useful without correction for variation in the temperature of the milk provided its temperature lies between 58 degrees F. and 62 degrees F. (3). Where samples are at any temperature between these limits, or can readily be brought to have temperatures within these limits, this total solids lactometer will effect great economy of time in routine milk analysis. If the readings upon it lie between 11.2 per cent. total solids and 12.7 per cent. total solids, the temperature of the milk may range within the wider limits 56 degrees F. to 63 degrees F. without any necessity of correction for temperature (4).

The total solids lactometer was derived from another new lactometer recently discussed in detail elsewhere and called by the writer, for the lack of a better name, the rational lactometer (5). If the paper scale of the rational lactometer could be removed and replaced by a paper scale properly graduated in total solids, the total

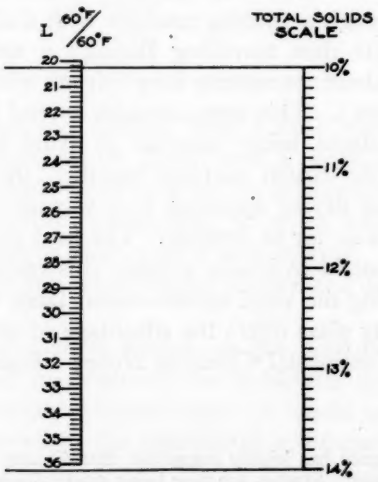

Fig. 1—Relation between the total solid lactometer and the rational lactometer.

solids lactometer would be the result. There is no other difference between these two new lactometers. The relation between the scales of these two instruments is shown in Figure I. The scale on the left in the cut is the scale of the rational lactometer; the scale of the total solids lactometer is the one on the right.

The total solids scale may be gotten by use of the general milk equation:

$$\text{T. S.} = 0.25\ \text{L} + 1.2\ \text{F} + .14 \quad (6)$$

Thus for a milk containing 4 per cent. butter fat, we learn the relative location of the 10 per cent. total solids mark by simple substitution in the general milk equation (7). Similarly, the relative location of the mark for 14 per cent. total solids is found. The values in terms of the rational lactometer scale are 20.24 and 36.24, respectively. For very good reasons, which can not be gone into again here, the rational lactometer scale was given a length of 4 centimeters between the 26 and the 36 marks (8); for the same reasons, the total solids lactometer scale is made 4 centimeters long between the 10 per cent. and the 14 per cent. marks. These reasons have to do with the general milk equation (9), with the average error in the Babcock centrifugal method (10), with the recommendations of the U. S. Bureau of Standards with respect to the openness of scale upon hydrometers (11), with a factor introduced to give the widely desired assurance of ample accuracy (12) and, lastly, with ruggedness and durability. The original paper upon the rational lactometer covers these reasons, as well as those for using a uniformly graduated scale rather than an harmonic scale (13), and those for regarding as useless any temperature corrections for readings ranging from 20 to 36 on milks with temperatures within the four degrees from 58 degrees to 62 degrees F. and for readings from 25 to 31 on milks with temperatures within the seven degrees from 56 degrees to 63 degrees F.

A rational lactometer such as I find adapted to the requirements of my own practice can be made, having any desired size of bulb, by use of the equation:

$$\text{D} = .07136 \times \sqrt{\text{V}}$$

where V is the displacement (volume) of the bulb in cubic centimeters and D is the corresponding diameter of stem in centimeters required to go with this bulb (15). The proportionality constant .07136 involves certain arbitrary values, namely, 0.1 per cent. butter fat as the average error in the Babcock centrifugal method as

practiced in my own laboratory, 0.08 centimeter as a suitable openness of scale, 1.5 as a "factor of satisfaction" (16) insuring ample accuracy in reading the scale. Those who prefer to use other values for any or all of these three factors in the constant should use the following more general formula in place of the one just given:

$$D = .078175 \times \sqrt{\frac{B}{O \times f}} \times \sqrt{V}$$

where D and V have the same significances as before, and where B represents the average error in the Babcock centrifugal method, O represents the desired openness of scale, and f represents the "factor of satisfaction" already referred to (17).

It should scarcely be necessary to add that the use of the total solids lactometer is no more intended to do away with the check by gravimetric determination of total solids in all exceptionally important cases, than is the use of any other lactometer. Its use is merely a short cut in routine work. It is an instrument deliberately made to have the sensitivity conformable to routine milk analysis of today (18), and deliberately made to give directly or after simple correction the figure (for total solids) that is otherwise arrived at indirectly by calculation through the general milk equation. It must be evident that one preferring to use the rational lactometer, or some equivalent, within the temperature limits set forth above, may take advantage of Figure I and use it for learning directly the per cent. of total solids corresponding to the lactometer reading observed—provided one corrects, as directed above, for departures from a 4 per cent. butter fat content.

REFERENCES

1. The rational lactometer, from which the total solids lactometer herein described is directly derived, has been worked out in full detail in a monograph (by the writer) that appeared in the Bulletin of the Wagner Free Institute of Science, Vol. X, No. 1, February, 1935. It is hardly justifiable to repeat the argument and the bibliography in that monograph. References will therefore be made to this Bulletin throughout the present paper; in order to distinguish these references, they will be caracterized by stating them in italics. Single numbers of the Bulletin are obtainable from Carl Boyer, Director Wagner Free Institute of Science, Seventeenth Street and Montgomery Avenue, Philadelphia, Pennsylvania.

2. Cf., *page 4 and foot note 23.*

3. Cf., *page 7 and foot note 38.*

4. 25 per cent. to 50 per cent. of the market milks examined in my laboratory fall within the limits of 11.2 per cent. and 12.7 per cent. of total solids.

5. The rational lactometer of the writer has been marked by the Arthur H. Thomas Co., West Washington Square, Philadelphia, Pennsylvania. They will also supply the total solids lactometer herein described.

6. With respect to the best value for the constant k see *foot note 23.*
7. Thus for 10 per cent. total solids, substituting into the general milk equation we get $10 = 0.25\ L + 4.8 + .14$. Transposing and clearing gives $L = 40.00 - 19.2 - 0.56 = 20.24$.
8. Cf., *pages 5 and 7.*
9. For partial differentiation of the general milk equation see *page 4.*
10. Cf., *page 5 and foot note 24.*
11. Cf., *page 5 and foot note 25.*
12. Called "the factor of satisfaction" on *page 5.*
13. Cf., *page 5 and foot note 26.*
14. Cf., *page 10 and foot note 38.*
15. Cf., *page 6.*
16. Cf., *page 7.*
17. Cf., *pages 1 to 4.*
18. There is a table (Table II) and a figure (Graph II) to be found on *page 8* by the use of which any lactometer may be rapidly classified from the point of view of its adaptability to the purposes of modern milk analysis. The measurements required are two: the volume of water or other liquid displaced by the bulb, and the average diameter of the stem. A statement will be found there of the findings when commercial specimens of the following were examined: the New York Board of Health lactometer (misnamed) Quevenne lactometers, the U. S. Department of Agriculture lactometer of Shaw & Eckles, and the California State lactometer of Dr. Stone. The dimensions suggested by Dr. Babcock are also considered there.

SWEAT, COMPOSITION OF. B. A. McSwiney. (*Lancet, Lond.*, 1934, *226*, 641.) Although sweat may be hypotonic in comparison with the blood plasma, yet it removes large quantities of sodium chloride from the body. Under normal conditions, from 600 to 700 mils are evaporated from the skin in twenty-four hours. The constituents of the perspiration are very variable. The average values calculated by Vass and McSwiney from the examination of fourteen male and ten female specimens are as follows:

Subject	*p*H	Ammonia -N	Urea Mgm. per	Amino-acid-N 100 mils	Glucose	Chlorides as NaCl gm. per 1,000 mils
Female	6.57	6.0	19.23	6.5	20.0	3.00
Male	6.14	4.7	21.44	5.0	12.6	3.70

Traces of creatine and creatinine have been found, and lactic acid was present in amounts not exceeding 120 mgm. per 100 mils. The variation in the figures recorded for the *p*H of perspiration may be due to bacterial decomposition. Sweat from rheumatic patients showed no marked divergence from the normal. Discussion of the factors controlling the mechanism of sweating by recent investigators is reviewed. Adrenaline has no action on the sweat glands; pilocarpine excites their activity and atropine paralyzes it. Recent work suggests that impulses are chemically transmitted by acetylcholine, liberated at the nerve endings which act on the sweat glands.—(J. O. B., *Quart. J. of Ph. and Pharmacology.*)

SCIENTIFIC AND TECHNICAL ABSTRACTS

Compiled by Arthur Osol, Ph. D.

Determination of Hypophosphites. Assoc. Official Agr. Chem. *Jour. Assoc. Official Agr. Chem, 18,* 87 (1935). The following methods were tentatively adopted. To determine total hypophosphites place 25 cc. of the sample in a 100 cc. volumetric flask, dilute to mark and mix thoroughly. To a 10 cc. aliquot add 25 cc. of HNO_3, boil on hot-plate until the volume is reduced to 2-3 cc.; add 10 cc. of HNO_3 and boil until volume is again reduced to 2-3 cc. Cool, add 20 cc. of H_2O, then NH_4OH in excess and barely dissolve the precipitate formed with a few drops of HNO_3, stirring vigorously. To the hot solution add 70 cc. of molybdate solution for each 0.1 g. of P_2O_5 present. Digest at about 65 degrees for one hour, and test for complete precipitation by the addition of more reagent to the clear, supernatant liquid. Filter, and wash with NH_4NO_3 solution.

Dissolve the precipitate on the filter with NH_4OH (1 + 1) and hot H_2O and wash into a beaker to a volume of not more than 100 cc. Neutralize with HCl, using litmus as indicator; cool; from a buret add slowly (about 1 drop per second, stirring vigorously) 15 cc. of the magnesia mixture for each 0.1 g. of P_2O_5 present. After 15 min. add 12 cc. of NH_4OH and allow to stand overnight. Filter, wash, the precipitate with the dilute NH_4OH until the washings are practically free from chlorides; dry, burn first at a low heat and ignite to constant weight, preferably in an electric furnace, at 950-1000 degrees, cool, and weigh as $Mg_2P_2O_7$. Report result as grams of P_2O_5 per 100 cc.

Calcium: Using the solution as prepared for the hypophosphite determination, pipet a 20 cc. aliquot into a 400 cc. beaker, dilute to 100 cc., add 2 cc. of HCl, 15 cc. of $NH_4C_2H_3O_2$ solution (10%) and a slight excess of saturated $NH_4C_2H_3O_2$ solution. Heat to boiling and allow the precipitate to settle at a temperature just below boiling. Filter hot, wash with 1 per cent. $NH_4C_2H_3O_2$ solution, dry, moisten with H_2SO_4, ignite gently, and weigh residue as $CaSO_4$. Calculate as grams of Ca per 100 cc.

The molybdate, ammonium nitrate, and ammonium hydroxide washing solutions, as well as the magnesia mixture, are prepared according to directions in *Methods of Analysis, A. O. A. C.* 1930,

p. 14. The determination of hypophosphites is applicable in the absence of phosphates, if phosphates are present, make a suitable correction.

Determination of Santonin in Mixtures. Assoc. Official Agr. Chem. *Journ. Assoc. Official Agr. Chem., 18,* 87 (1935). Weigh 2.5 g. of the ground sample into a Gooch crucible and wash with about 100 cc. of petroleum ether saturated with santonin. Discard the washings. Extract with about 100 cc. of hot benzene (crystallizable), collecting the filtrate in a beaker. Evaporate to dryness, warm the residue with alcohol until dissolved, transfer to a 100 cc. volumetric flask, cool, make up to volume at 20 degrees, and filter if necessary. To 25 cc. of the solution add 50 cc. of dinitrophenylhydrazine sulfate solution (prepared by dissolving 1 g. of 2:4 dinitrophenylhydrazine in a mixture of 90 cc. of H_2O and 10 cc. of H_2SO_4 by warming, then cooling and filtering) and allow to stand for 48 hours in a dark place. Filter on a Gooch crucible and wash with diluted alcohol (1 volume of alcohol to 2 volumes of H_2O), using a total volume of about 150 cc. Dry the residue 1 hour at 100 degrees, cool, and weigh. Weight of precipitate x 0.5775 = weight of santonin.

Determination of Alkaloids in Ergot. Assoc. Official Agr. Chem. *Journ. Official Agr. Chem., 18,* 88 (1935). The alkaloids are extracted as follows: Pipet 5 cc. of the fluidextract at 20 degrees to a separator and dilute with 30 cc. of H_2O. Add 2 cc. of NH_4OH (1 + 10) or until distinctly alkaline to litmus paper. Extract with peroxide-free ether, using 40, 25, 20, 15 cc. portions, or until the alkaloids are removed completely. (To assure complete extraction make an additional extraction with 20 cc. of ether, evaporate in separate beaker, dissolve the residue in 1 cc. of 1 per cent. tartaric acid solution and test with reagent for blue color.) Combine the ether extractions in a separator, wash at least three times with 25 cc. portions of H_2O containing three drops of NH_4OH to remove the yellow pigments, and finally wash twice with H_2O to remove the excess of alkali. Transfer the combined washings to a separator, extract with three 5 cc. portions of ether, wash the combined portions of the latter with H_2O, and add to the main ether extractions. Shake the ether with an aqueous 1 per cent. tartaric acid solution, using 10, 10, 10 and 5 cc. portions, respectively, until the alkaloids are removed

completely. Evaporate the combined acid solutions on a water bath in a current of air to remove the ether, transfer the solution to a 25 cc. volumetric flask, and make up to volume.

Colorimetric Comparison: Pipet 1 cc. of the standard solution (containing 0.01 g. of ergotoxine ethanesulfonate or ergotamine tartrate and 0.05 g. of tartaric acid in 100 cc.) at 20 degrees to a glass colorimeter cup or test tube and add 2 cc. of reagent (made by dissolving 1.25 g. of paradimethylaminobenzaldehyde and 0.05 g. of ferric chloride in a cooled mixture of 650 cc. of H_2SO_4 and 300 cc. of H_2O and diluting to 1 liter with H_2O). Mix. Pipet 1 cc. of the extracted ergot solution to a second cup or test tube and add 2 cc. of the reagent. Mix. Allow to stand for 30 minutes or until the blue color reaches maximum intensity. Read in a colorimeter. Repeat the comparison if necessary with aliquots of the alkaloidal solutions to produce about the same color intensity as the standard. Calculate the percentage of total alkaloids of ergot as ergotamine tartrate or ergotoxine ethanesulfonate.

Determination of Nitrites in Tablets. Assoc. Official Agr. Chem. *Journ. Official Agr. Chem., 18,* 89 (1935). The following method was adopted as tentative: Count and weigh a suitable number of tablets to ascertain the average weight. Reduce to a fine powder, mix thoroughly, and keep in a tightly stoppered bottle.

Transfer to a 100 cc. volumetric flask the equivalent of about 1 g. of sodium nitrite, add H_2O to the mark and mix thoroughly. Filter through a dry filter, rejecting the first 10 cc. Transfer a 50 cc. aliquot to a 200 cc. volumetric flask. Add in order, 10 cc. of saturated $KClO_3$ solution, then slowly and with shaking, 10 cc. of HNO_3 (1 + 1) and allow to stand for 30 minutes. Add 50 cc. of 0.1 N $AgNO_3$ solution and make up to mark with H_2O. After mixing thoroughly, filter through a dry filter, rejecting the first 20 cc. of the filtrate. To 100 cc. of the filtrate add 2 cc. of ferric ammonium sulfate solution (8 grams in sufficient H_2O to make 100 cc.) and titrate with 0.05 N KCNS solution. Make a blank determination and correct if necessary. Each cc. of 0.1 N $AgNO_3$ solution is equivalent to 0.020703 g. of $NaNO_2$.

Note: Correct for any chloride that may be present in sample. In case a large quantity of insoluble excipient is present, pipet 100 cc. of H_2O into a flask with the powdered sample in order to avoid any error in volume.

Determination of Podophyllum. Assoc. Official Agr. Chem. *Journ. Official Agr. Chem., 18,* 89 (1935). The following method was adopted as tentative: Place 10 g. of drug in No. 60 powder in an Erlenmeyer flask of about 200 cc. capacity and add 35 cc. of alcohol. Fit the flask with a stopper through which is inserted a glass tube about 100 cm. in length to act as a condenser, and place the flask on a gently simmering steam bath for 30 minutes. Transfer the contents of the flask to a small percolator and percolate slowly with hot alcohol until about 95 cc. of percolate has been obtained. Collect about 10 cc. more of the percolate in a separate container. Cool the first percolate to room temperature and make up the volume to 100 cc. with a portion of the second percolate.

Place 50 cc. of the alcoholic solution in a tared beaker and add 2 cc. of H_2O. Evaporate until the percolate weighs 3 g. Pour the residue slowly, with constant stirring, into a second beaker containing 10 cc. of H_2O previously mixed with 1 cc. of normal HCl and cooled to a temperature below 10 degrees. Add 5 cc. of H_2O and a few drops of dilute HCl to the tared beaker, stir well, and rub the sides of the container with a glass rod. Add the mixture to the second beaker and allow to stand overnight in a refrigerator. Decant the supernatant liquid into a tared Gooch crucible and transfer the precipitate to the crucible by means of small portions of cold H_2O slightly acidulated with HCl. (If preferred collect the precipitate on a filter paper and, after washing, dissolve in hot alcohol, collecting the solution in the tared beaker.) Dry the contents of the crucible at 80 degrees, and weigh. If particles of resin adhere to either beaker, dissolve them in alcohol, evaporate the solvent in the tared baker, and dry the residue at 80 degrees. Cool, weigh, and add the total net weight to the weight of the contents of the crucible.

Herring Fish Oil. Optimistic reports have appeared in the Swedish press concerning a new process for extracting a vitamin-rich oil from herrings. Following experimental work extending over three years the results obtained are stated to have justified the erection of a factory which will commence working at the beginning of the trawling season. The new process, which may solve the problem of utilization of surplus herrings, will be run in conjunction with fish meal manufacture, 15 tons of fish meal accumulating during manufacture of 2 tons of the vitamin-rich oil. Owing to the high percentage of vitamin D present in the herring fish oil, which also contains vitamin A, this oil may form a substitute for fish liver oil. From Continental Chemical Notes, *Chemical Age, 32,* 226 (1935).

SOLID EXTRACTS

By Ivor Griffith, Ph. M., Sc. D.

Now we know!—why that primary gastric sacrifice we made at the altar of my Lady Nicotine was so like sea-sickness—and the explanation of the omitted verse in Hood's nostalgic poem—

I remember, I remember, my first tobacco spree,
The caustic corner of the plug
That Bob bestowed on me;
"Now swallow hard"—the rascal said,
And I obeyed—of course.
They took me home—a languid lump
Of over-ripe remorse.

A person poisoned by nicotine stops breathing because the nerve endings in the muscles of his breathing apparatus are paralyzed. The drug does not paralyze the breathing center in the brain, as has been generally believed.

These discoveries which suggest a new method of treating nicotine poisoning were reported to the American Society for Pharmacology and Experimental Therapeutics.

Artificial respiration, rather than drugs to stimulate the breathing center in the brain, is the method suggested by the Cornell investigators for treating cases of nicotine poisoning in which breathing has been dangerously slowed or stopped altogether.

Air, considered by the Greeks, to have been an imponderable element, is now known to be a most conglomerate mixture—and more conglomerate now than ever, since the radio has ruined its inherent character. This is the most recent analysis of the "air we breathe."

Substance	*% by volume in dry air*
Nitrogen	78.03
Oxygen	20.99
Argon	0.9323
Carbon Dioxide	0.03
Hydrogen	0.01
Neon	0.0018
Krypton	0.0001
Helium	0.0005
Ozone	0.00006
Xenon	0.000009

Glauber's salt has always had a bombastic complex—for its very beginnings found it ballyhooed, though not nearly as much as in its present, crazy crystal form.

Johann Rudolph Glauber, a German chemist, discovered, in 1603, in the waters of a Hungarian spring, this salt which he found had peculiar laxative qualities. With customary modesty he called it Glauber's Miraculous Salt! He even went to the trouble of synthesizing the salt, identified later as sodium sulphate. He made other discoveries and sold his secrets, probably to the highest bidder.

But Glauber was a piker *compared to those who now build fortunes selling this equine drug to asinine consumers.*

In spite of our alleged progress in the etiology of goiter and other thyroid disorders, warning comes from Dr. Arnold Jackson of Madison, Wis., that thyroid diseases are decidedly on the increase. As many as four-fifths of the girls and one-fifth of the boys living in the great goiter belt, which extends from Boston to Seattle, are afflicted with goiter, Dr. Jackson found in a nation-wide survey of the problem. Cretinism, resulting from this type of goiter, is more prevalent in the United States today than at any time in the nation's history. Efforts to prevent goiter, Dr. Jackson stated, have fallen off since the financial depression.

A scale that weighs the atom is science's latest achievement. The existence of this new "scale" for weighing individual atoms that occur by the billions in a single speck of matter was revealed by Prof. A. J. Dempster, of the University of Chicago, to the American Philosophical Society, which Benjamin Franklin founded in 1727 and which is the oldest learned society in the United States.

Dr. Dempster's atom "scale" is known to science as the mass spectrograph. Although the device itself weighs several tons, it can determine the weight of individual atoms. It is used in detecting isotopes of the various kinds of matter, the varieties of a substance like chlorine or oxygen, which are chemically indistinguishable but have slightly different weights.

A new peril in modern dentistry is suggested by a report recently presented by the Harvard Dental School. On the basis of its own inherent toxicity, mercury in gold amalgam has long been frowned upon by European researchers in this field.

But it is the galvanic currents set up by discordant metals in the dental fillings and plate or bridge materials that are feared by the Harvard workers.

Alloys of different electrical potentials have been found by them to cause irritation of the gums, tongue and cheek tissues and may be a contributing factor in cancer and other malignant diseases of the mouth according to their report.

Trachoma, an eye disease, which has for ages harassed the people of certain countries of the near East, was so rampant among children attending Jewish schools in Palestine, that medical authorities there concentrated their efforts upon its eradication. Their brilliant success is indicated by a recent report of the Hadassah Medical Organization, which announces a reduction in its incidence among school children, from 34 per cent. to 6.3 per cent. in a little over fifteen years.

Methylchloranthrene is a chemical made from the bile acids of the human body and is cancer-causing when applied locally. Harvard chemists have been able to make it synthetically . Artificial manufacture of the substance will aid cancer research by making available quantities of the carcinogenic agent for animal experiments.

It is from such animal experimentation that science hopes to learn the particular pattern in the molecule that is able to start the malignant growth or cancer.

BOOK REVIEW

ECONOMIC PLANTS, by Ernest Elwood Stanford, Ph. D., D. Appleton-Century Company, New York.

This volume helps to supply a long-felt need on the part of student, teacher and interested layman for a thoughtful, clearly written, general textbook and reference work dealing with economic plants and plant products.

An inspection of the chapter headings will give the reader some idea of the great number of the subjects treated. Following some of the chapter headings, I have briefly indicated in parentheses certain topics treated in the chapter. Chapter I. The Plant Kingdom. Chapter II. Cells, Tissues and Organs. Chapter III. Forest Products: Wood, Timber, and Lumber. Chapter IV. Forest Products: Uses, Distribution, and Kinds of Wood. Chapter V. Forest Products: Resins, Tanning Materials, and Cork (rosin, turpentine). Chapter VI. Forest Products: Rubber and Other Latex Products (rubber, gutta percha, balata, chicle). Chapter VII. Textile Plants and Products (cotton, flax, hemp, jute, ramie, sisal, coir, kapok). Chapter VIII. Paper and Pulp. Chapter IX. Food Products: Cereals and Allied Crops (wheat, barley, oats, rye, rice, maize). Chapter X. Sugar and Sugar Plants (cane, beet, palm, sorghum, maple, honey). Chapter XI. Fixed Oils (cottonseed, olive, cocoanut, palm, castor, linseed, tung). Chapter XII. Plants and Nitrogen: Protein Products (alfalfa, cowpea, vetches, soy bean, peanut, nuts of various types). Chapter XIII. Food Products: Certain Fruits (apple, peach, cherries, orange, lemon, grapefruit, grapes). Chapter XIV. Spices and Other Aromatic Products (black and white pepper, red pepper, nutmeg, mace, cinnamon, ginger, vanilla, peppermint, rose oil, citronella, camphor). Chapter XV. Beverage Yielding Plants (coffee, tea, cocoa, cola, yerba mate). Chapter XVI. Medicinal Plants (opium, cinchona, cascara).

The style is refreshingly clear and enjoyable. The illustrations are well chosen and abundant. While structure has not been slighted, emphasis has been placed upon production and use.

It has not been the intention of the author to give each topic or group of topics encyclopedic treatment. For example, the pharmacognocist might find the chapter on medicinal plants inade-

quate for his special needs. Treatment of certain economic plants has been omitted. But the author has achieved his purpose of a general textbook which is clearly written and sufficiently comprehensive to make its possession indispensable to those interested in plant science.

M. S. DUNN.

PHENYLMERCURIC NITRATE. F. L. Pyman and H. A. Stevenson. (*Pharm. J.*, 1934, *133*, 269.) The salt used under this name by investigators who have reported favorably on its value as a bactericide, is the basic salt, $C_6H_5HgOH,C_6H_5HgNO_3$, and not the normal salt, $C_6H_5HgNO_3$, which is now described for the first time. Normal phenylmercuric nitrate, m.pt. 130 degrees to 132 degrees C. may be obtained by the action of nitrogen tetroxide on diphenylmercury in non-dissociating solvents. It readily changes into the basic salt on crystallization from moist alcohol. The pure basic salt is soluble in water only to the extent of 0.049 per cent. at 24 degrees C.—J. O. B.

PHENYLMERCURIC NITRATE, PREPARATION OF. G. H. Woolett and V. A. Coulter. (*J. Amer. Chem. Soc.*, 1934, *56*, 1922.) When diphenylmercury in chloroform is vigorously shaken with an aqueous solution of mercuric nitrate and the mixture dissolved in boiling alcohol, nearly pure phenylmercuric nitrate, m.pt. 188 degrees C., crystallizes out. After melting, the compound decomposes explosively at 270 degrees C. The following give a 75 per cent. yield: mercuric nitrate, 3.49 gm.; chloroform, 50 mils; diphenylmercury, 3.54 gm.; water, 3 mils; alcohol, 600 mils. The compound is soluble at 5 degrees C. to the extent of 0.05 gm. and 0.08 gm. per 100 mils of water and alcohol respectively, and 0.9 gm. and 0.51 gm. per 100 mils at the boiling points of the respective solvents.—B. W. M.

(Ed. Note—These two abstracts from the *Quarterly Journal of Pharmacy and Pharmacology*, London, England, suggest that there is still some confusion regarding this most recent addition to our bacteriostatic agents.)